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July 19, 2004

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APPLICATION NUMBER: *60/545,470*

FILING DATE: *February 19, 2004*

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PATENT APPLICATION SERIAL NO. ____________________

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PTO/SB/16 (6-95)
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Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

# PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53 (c).

| | Docket Number | 2380-821 | Type a plus sign (+) inside this box→ | + |
|---|---|---|---|---|

INVENTOR(S)/APPLICANT(S)

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22581 U.S. PTO
60/545470
021904

TITLE OF THE INVENTION (280 characters)

SIGCOMP DICTIONARY UPDATES BASED ON COMPRESSION FACTORS

CORRESPONDENCE ADDRESS

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification — Number of Pages: 6

☐ Drawing(s) — Number of Sheets:

☐ Applicant claims "small entity" status.

☐ "Small entity" statement attached.

☐ Other (specify)

METHOD OF PAYMENT *(check one)*

☒ A check or money order is enclosed to cover the Provisional filing fees ($160.00)/($80.00)

☒ The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. A duplicate copy of this sheet is attached.

PROVISIONAL FILING FEE AMOUNT ($): 160.00

The invention was made by an agency of the United States Government or under a contact with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

SIGNATURE

DATE: February 19, 2004

TYPED or PRINTED NAME: John R. Lastova

REGISTRATION NO. *(if appropriate)*: 33,149

☐ Additional inventors are being named on separately numbered sheets attached hereto.

## PROVISIONAL APPLICATION FILING ONLY

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INVENTION DISCLOSURE

# 1 Technical information

## 1.1 Name of invention

SigComp Dictionary updates based on Compression Factors

## 1.2 Inventor(s)


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## 1.3 Background

Ericsson is currently developing an open standard for a service called Push-to-talk over Cellular (PoC) that will be applied in handsets for GSM, EDGE, UMTS and CDMA systems.

PoC is basically a voice chat for cellular telecommunication systems. PoC enabled handsets will most likely be equipped with a PoC-button. The PoC button may for example be; a dedicated hardware button, an assigned button on the standard keypad, or a software button used in e.g. pressure sensitive screens. When the PoC button is pressed the handset connects you directly to another user or user group. In the first releases of PoC the service is half-duplex, although full duplex may be available at a later stage.

One of the important features that PoC will support is Presence. This means that the user can get information about the status of one or several users in his contacts list that he has selected for the presence service. The presence information is sent to the user in the form of SIP [1] messages. These updates may be sent according to different principles, e.g. using push or pull strategies.

The compression scheme SigComp, see [2] and [3], is used in PoC to compress SIP messages. SigComp consists of a simple protocol and a Universal Decompressor Virtual Machine (UDVM). The protocol part defines for example the message format and a set of rules that describe how to load information into the UDVM. The UDVM provides the decompressor functionality of SigComp. Any compressed message can be decompressed provided that the UDVM is loaded with the correct set of instructions to interpret the format of the compressed data. Further, a SigComp compressor endpoint has the ability to save information at the receiving decompressor endpoint in the form of states. The states are typically information from previous messages used to update the dictionary or codebook used by the compression algorithm. These states can then be retrieved by the UDVM as new compressed messages arrive.

Binary compression algorithms, such as Deflate [4] and LZSS [5], uses a buffer referred to as dictionary, which contains data that are referenced in the compressed message. Basically, the foundation of dictionary compression is pattern matching and substitution, i.e. finding and replacing groups of consecutive symbols (strings) with an index into a dictionary. This results in compression if the representation of the index is shorter than the string it replaces.

The compression performance depends to a large extent on the contents of the dictionary that has been saved as a SigComp state. In the most frequently used compression mode, Dynamic compression, the dictionary is updated as new messages are compressed and sent. The dictionary is typically updated by adding the last message to the circular buffer that contains the dictionary.

For simplicity when referring to SigComp in the text from here on, it should be understood as the protocol SigComp in combination with a compression algorithm, such as Deflate.

## 1.4 State-of-the-art

When dynamic compression is used in SigComp the old parts of the dictionary are shifted out when the dictionary is updated due to limited amount of memory. For compression of SIP Invite sessions (for PoC session set up), for which SigComp has been optimized, this is of little concern since the newer parts of the dictionary typically contain more recent and useful strings.

## 1.5 Problem

When the presence service is used the Presence server sends updates, e.g. by using the SIP NOTIFY method, to the terminal. The terminal acknowledges the updates, e.g. by a SIP 200 OK message, and hence the SigComp dictionary may also be updated. The presence updates can be frequent, at least compared to the session initiation signalling and also occur during the entire time that the user is registered.

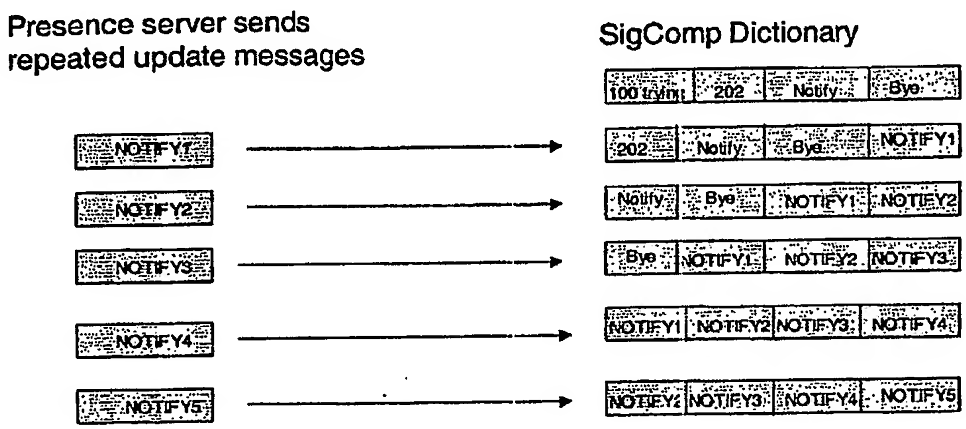


Figure 1. Example of consequences of dictionary updates when Dynamic compression is used for compression of Presence related signalling.

Since the old content of the dictionary is shifted out, there is a risk that useful information is deleted. In the case of Presence updates this risk is significant. The Presence updates may be a list of user's status. Hence, the list is expected to be more or less identical from message to message. When dynamic compression mode is used in this case, the dictionary will end up being a number of almost identical copies of the status list or SIP 200 OKs. As the user then initiates a new session (a new SIP Invite dialogue) the dictionary is filled with less useful strings and the compression efficiency is not as high as it potentially could be. The result is longer time for this session set up signalling than would have been the case if the dictionary had been left unchanged. Since short set up time is one of the most important design goals of the PoC standard, this is a serious drawback.

## 1.6 Solution

The solution to this problem is to make sure that the dictionary is not updated if the message is too similar to what is already in the dictionary. This similarity can be measured by the compression factor obtained on the message. If the message can be compressed efficiently (high compression factor), this implies that the content in the dictionary is very similar to the message. If this is the case then there is no need to update the dictionary. Hence, this invention is to base the decision on whether to save the message in the dictionary on the obtained compression factor. If the compression factor is below some limit the message is used to update the dictionary. While if the compression factor is above the same limit it is not saved. The compression factor is measured by the compressor which then indicates to the decompressor whether the message should be used to update the dictionary or not. The indication is preferably implemented as a bit flag in a the SigComp part of the message that is read by the UDVM. Thus, the UDVM is instructed to read this bit flag, and depending on the value (0/1) of the bit flag the UDVM may update the dictionary, i.e. save a new state, with the content of the current decompressed message.

The compressor decision whether to update the dictionary can be based on a fixed compression factor limit, a compression factor limit that is adaptive e.g. based on an average compression factor for some compressed messages.

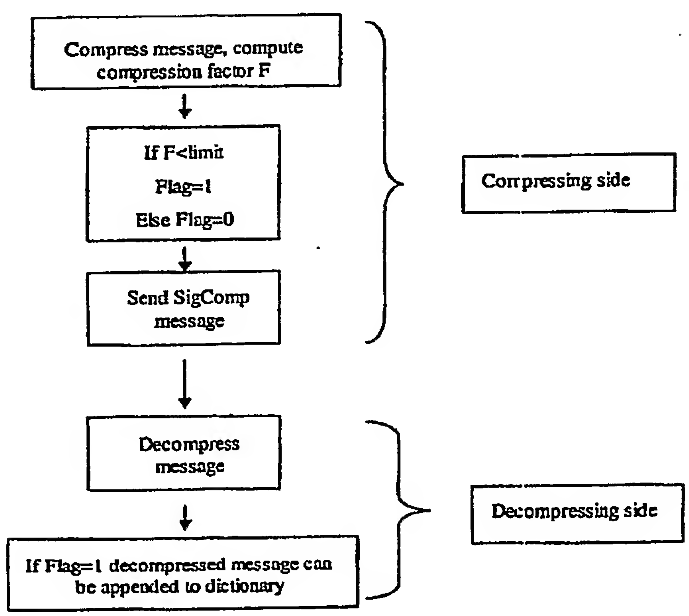


Figure 2. Algorithm for dictionary updates

## 1.7 Merits of the invention

The overall merit of the invention is that it will increase the compression performance when dynamic compression is used together with Presence. This will result in reduced set up times for push to talk sessions. Other advantages of the invention are

- Messages that are very similar to the contents of the dictionary, and hence are not useful for the compression performance, do not waste state memory since they are not saved.
- The risk of pushing out useful contents of the dictionary and replacing it with multiple "copies" of the same message is minimized.
- In scenarios with a SIP invite followed by a number of Presence updates the standard Dynamic compression would fill the dictionary with copies of presence updates. This would lead to bad compression performance when a new SIP invite dialogue is to be compressed. With the present invention this is not the case.
- The invention is easy to implement compared to other dictionary update strategies, e.g. adding unmatched strings to the dictionary. The ease of implementation leads to shorter byte codes than would be needed for more complex strategies.
- The invention can be used for different compression algorithms such as Deflate, LZSS and other. The invention does not depend on the compression algorithm, other than through the compression factor obtained.
- The invention has particular importance for the proxy implementation, since this is the side that would issue the presence updates. Hence, the invention should be of particularly useful for E/// products.

## 1.8 References


[1] Rosenberg, J. et. Al "*SIP: Session Initiation Protocol*". RFC3261, Internet Engineering Task Force, June 2002.

[2] Price, R. et. Al. "*Signaling Compression (SigComp)*", RFC3320, Internet Engineering Task Force, December 2002.

[3] Hannu, H. et. Al. "*Signaling Compression (SigComp) – Extended Operations*". RFC3321, Internet Engineering Task Force, December 2002.

[4] Deutsch, P. et. Al. "DEFLATE Compressed Data Format Specification version 1.3" RFC 1951, Internet Engineering Task Force, May 1996.

[5] Storer, J. A. And Szimanski, T. G. *"Data Compression via Textual Substitutions"*, Journal of the ACM 29, 1982.

## 1.9 Claims proposal